

## Ultra Low Emission Bus Scheme Certificate

Customer:	Alexander Dennis			<b>DYNAMOMETER SETTINGS</b>		
Customer Address:	Dennis Way, Guildford, Surrey, GU1 1AF			Measured Kerb Weight (kg)		N/A
Test Purpose:	ULEB Testing	Test Type:	Certification	Equivalent test passengers		33.5
Vehicle Manufacturer:	Alexander Dennis	Seated Capacity	67	Test Weight		15130kg
Vehicle Type & Number:	Alexander Dennis E400H, G445	Passenger Capacity	86	F°	400.94	N
Engine:	Cummins ISB4.5 e6 VI	Declared Kerb Weight (kg)	12777	F <sup>1</sup>	-23.0263	N/kmh
Transmission:	BAE Series ER Hybrid HD100	Gross Vehicle Weight (kg)	18750	F <sup>2</sup>	1.02000	N/kmh <sup>2</sup>
Euro VI certificate Y/N	Manufacturer Certified	GVW CHECK	OK	F <sup>3</sup>	-0.008550	N/kmh <sup>3</sup>

### Declared fuel, properties and source plus carbon conversion factors

Net Heating Value: Diesel	36.00	MJ / Litre	Fuel Provider	UK market standard
Well-to-Tank Factor: Diesel	17.02	g CO <sub>2</sub> e / MJ	WTT evidence	UK GHG reporting factors 2020
Well-to-Tank Factor: Electricity	80.04	g CO <sub>2</sub> e / MJ	Fuel Type	UK Pump Diesel, UK Grid Electricity

### Emissions and Energy consumption results from approved test facility - Average 3 tests

Test Phase	HC (g/km)	CO (g/km)	NOx (g/km)	PM (g/km)	CO <sub>2</sub> (g/km)	CH <sub>4</sub> (g/km)*	N <sub>2</sub> O (g/km)*	Energy Consumption (kWh/km)	Fuel Consumption (l/100 km)	Fuel used over phase/cycle (litres)
Outer Urban	0.001	0.001	0.294	N/A	1060.5	0.004	0.226	N/A	40.04	2.547
Inner Urban	0.003	0.006	0.015	N/A	0.0	0.000	0.000	1.244	0.00	0.000
Rural	0.000	0.000	0.409	N/A	620.4	0.001	0.137	N/A	23.42	1.724
LBC Average	0.002	0.002	0.216	N/A	765.3	0.000	0.163	N/A	28.90	2.547
UKBC Average	0.001	0.001	0.304	0.0111	699.4	0.002	0.152	N/A	26.40	4.270

### Zero Emissions (Z.E.) Range: Energy consumption and charging efficiency

Total measured energy consumed on vehicle (kWh)	N/A	Distance in Z.E. mode (km)	2.8	Usable Battery Capacity (kWh)	15
Measured grid energy during charging (kWh)*	N/A	Charging efficiency (%)	N/A	Max Theoretical Z.E. Range (km)	12.1

### Total Tank-to-Wheel GHG CO<sub>2</sub> equivalent

Test Phase	CO <sub>2</sub> (g/km)	CH <sub>4</sub> (g/km x 25)*	N <sub>2</sub> O (g/km x 298)*	Fuel TTW** GHG (CO <sub>2</sub> Equivalent g/km)
Outer Urban	1060.5	0.099	67.420	1128.0
Inner Urban	0.0	0.000	0.043	0.0
Rural	620.4	0.024	40.913	661.4
LBC Average	765.3	0.000	48.679	814.0
UKBC Average	699.4	0.050	45.159	744.6

### Calculated total Well-to-Wheel GHG CO<sub>2</sub> equivalent emissions over test

Test Phase	Fuel Energy (MJ / km)	Fuel WTT*GHG Emissions (g CO <sub>2</sub> e / km)	Electrical Energy (MJ / km)	Electricity WTT* GHG Emissions (g CO <sub>2</sub> e / km)	Measured Fuel TTW** GHG Emissions (g CO <sub>2</sub> e / km)	Total WTW*** GHG Emissions (g CO <sub>2</sub> e / km)
Outer Urban	14.41	245.3	N/A	N/A	1128.0	1373.4
Inner Urban	0.00	0.0	N/A	N/A	0.0	0.0
Rural	8.43	143.5	N/A	N/A	661.4	804.9
LBC Average	10.40	177.1	N/A	N/A	814.0	991.1
UKBC Average	9.51	161.8	N/A	N/A	744.6	906.4

Data Generated by (On behalf of Test facility):	Date: 23/06/2020	Data Approved by:	Date:
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### Ultra Low Emission Bus Certificate Summary

GHG Well-to-Wheel	906.4	g CO <sub>2</sub> e / km
Euro VI Average Diesel Equivalent	1315.9	g CO <sub>2</sub> e / km
WTW GHG saving (compared with Euro VI diesel equivalent)	409.5	g CO <sub>2</sub> e / km
% WTW GHG saving (compared with Euro VI diesel equivalent)	31%	g CO <sub>2</sub> e / km
Max Theoretical Zero Emission Operating Range (km)	12.1	km
WTW CO <sub>2</sub> per passenger km (@ Max Pass Capacity)	10.5	g CO <sub>2</sub> e/pass km
Approved as Ultra-Low Emission Bus? (30% saving or more)	<b>YES</b>	

\* WTT : Well-to-Tank      \*\* TTW : Tank-to-Wheel      \*\*\* WTW : Well-to-Wheel

<b>COMMENTS:</b> * compound measured via Fourier Transfer Infra-Red (FTIR), Values in RED are below levels of detectability. Phase 2 of each test conducted in EV Mode, Zero emissions for following distances: ML02019179: 2.66km, ML02019180: 2.97km, ML02019182: 2.78km During the phase, the following energy consumption was recorded (RESS: 600V): ML02019179: 1.179kWh/km, ML02019180: 1.177kWh/km, ML02019182: 1.375kWh/km	<b>Average Temperatures:</b>	Cell	Lower Saloon	Upper Saloon
		9.45	18.15	19.91

**Test Numbers:** ML02019179 (22-Jun-20), ML02019180 (22-Jun-20), ML02019182 (23-Jun-20). WTT Factors Published: 7th June 2019

Certificate approved by:	Certificate Approved by: Daniel Hayes
On behalf of Bus manufacturer	on behalf of DfT/Zemo Partners      01.07.20